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BULLETIN DU MUSÉUM NATIONAL D'HISTOIRE NATURELLE
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Halosauridae of the North Eastern Atlantic (Pisces, Teleostei, Notacanthiformes)

by C. M. H. Harrisson *

Résumé. — Pour chacune des quatre espèces d'Halosauridae connues dans le nord-est atlantique, sont données les références bibliographiques essentielles, ainsi que des renseignements concernant l'iconographie, l'habitat et la distribution géographique, les œufs et les larves.

The species of the family Halosauridae found in the North East Atlantic are the following : *Halosaurus ovenii* Johnson, 1863, *H. johnsonianus* Vaillant, 1888, *Halosauropsis macrochir* (Günther, 1878), *Aldrovandia phalacra* Vaillant, 1888, and perhaps *A. affinis* Günther, 1877. None of these is known from the Mediterranean. In the following account only primary sources are used, that is to say works which rely on a direct examination of specimens that can be traced. References to monographs compiling secondhand information are omitted, since it is often impossible to determine to what material the descriptions and name changes refer. To cover such secondary sources would require a complete review of the family and all specimens known. This is not attempted here. In the iconography, figures represent fishes viewed from the left side unless otherwise stated. It may be remarked that Lozano y Rey (1947) reproduces Collett and Vaillant's figures on his plate 11. Fowler (1936) does not show any original illustrations or discuss new material. His figures are modified outlines from Vaillant, Günther and Murray and Hjort.

Genus **HALOSAURUS** Johnson, 1863

Proc. Zool. Soc. London : 406 ; type : *H. ovenii* Johnson, 1863, a 465 mm female " from Madeira ".

Halosaurus ovenii Johnson, 1863

Halosaurus ovenii Johnson, 1863 : 406-408 (pl. XXVI, fig. 1). Type : British Museum (Nat. Hist.) London, in good condition (BMNH 1863.12.12.1), preserved in spirit.

H. owenii : Vaillant, 1888 : 175-181 (pl. XIV, fig. 5,5a-f ; pl. XV, fig. 1, 1a-c ; pl. XVI, fig. 3, 3a).

H. oweni : Collett, 1896 : 143 ; Poll, 1953 : 107, 108 (fig. 42, p. 110).

H. oveni : Marshall, 1962 : 259-261 (fig. 4, p. 260).

* *Institute of Animal Genetics, West Mains Road, Edinbourgh EH9 3JN, U.K. et Laboratoire des Pêches Outre-Mer, Muséum national d'Histoire naturelle, 43, rue Cuvier, 75005 Paris.*

Iconography

Johnson (1863) shows on plate XXVI, figure 1, a black and white lithograph at a little larger than half natural size of the type specimen, a gravid female from Madeira. Vaillant (1888) depicts scales from the body and the lateral line (fig. 5,5a, and 5e), and a lateral view of the viscera of a female specimen. His plate XV is another lithograph of a specimen taken off the Morocean coast at 0.8 times its natural size (fig. 1), together with dorsal and ventral views of the head (fig. 1a, 1b) drawn at a different enlargement, while the sagittal otolith of the right side is shown on plate XVI (fig. 3, 3a). The illustrations given by both Johnson and Vaillant show specimens with the tail reflexed. Poll (1953) shows a line drawing of his ripe female at 0.6 of its natural size with its tail extended. This specimen was taken off the mouth of the Congo. Marshall (1962 : 260) gives details of the swimbladder in his figure 4.

Eggs and larvae

Johnson's type has eggs ca. 1 mm in diameter (Harrisson, 1966 : 468) and was collected in February. Poll (1953) reports a specimen with ripe eggs taken in October. Vaillant (1888), whose material was collected between June and August, states that all the females of this species examined by him had small eggs. The larvae remain unknown.

Habitat and distribution

This species is chiefly benthic (like other members of the family), and is found in the Northeast Atlantic on mud, or sand and mud, on the upper slopes of the continental shelves at depths of from 500 m to 1 500 m and temperatures of from 5°C to 11°C. It occurs in the Azores, the Bay of Cadiz, and in Madeira, and has been recorded from off the mouth of the Congo (Poll, 1953) and from South Africa (Gilchrist and Von Bonde, 1924).

Halosaurus johnsonianus Vaillant, 1888

Halosaurus johnsonianus Vaillant, 1888, Exp. sci. « Travailleur et Talisman », Poissons : 181-184. Type : Mus. Hist. nat., Paris (MNHN 85-361), taken off the Soudan. This specimen measures 390 mm SL, is preserved in spirit, and reputedly is in good condition.

Halosaurus johnsonianus : Collett, 1896 : 143-146 (pl. IV, fig. 20) ; Roule, 1919 : 130 ; Koefoed, 1927 : 67 ; Pérès, 1958 : 280, 281, pl. 19, fig. 1, pl. 20, fig. 3, 4.

Iconography

Vaillant (1888), plate XV (fig. 2), shows a specimen with the tail reflexed (presumably the individual for which he gives measurements on page 183, in which case the figure is a life-size representation). Dorsal and ventral views of the head are given on the same plate (fig. 2a, 2b), as in the figure of a lateral line scale (fig. 2e) and a dorsal view of the brain (fig. 2d). Collett's plate IV is a lithograph of a black-and-white tone wash figure by Carl Nielsen, and shows the whole animal, a specimen from the Azores. The specimen, figured natural size, appears to be the larger specimen of 408 mm, a female,

of COLLETT's description on page 144. This fish was caught at 38°33'N, 28°08'W, Hirondelle station 233. PÉRÈS' pl. 19, fig. 1, pl. 20, fig. 3, 4 are photographs of live *Halosaurus*, probably *H. johnsonianus* as seen from the Bathyscaphe FNRS III.

EGGS AND LARVAE

A specimen taken on 18th August 1888 was reported by COLLETT (1896 : 144) as having eggs at different stages of development. (This specimen is that of his plate IV.) HARRISSON (1966) suggests this may indicate a long spawning period. The larva is unknown.

DISTRIBUTION

This species is benthic and lives on the middle slopes of the continental shelf at depths between 900 m and 2 000 m and at temperatures of between 5°C and 11°C. Many records are of captures on calcareous muds containing coral or broken shells. The species is known from the Atlantic west of Spain and Portugal, from the Bay of Cadiz, and from West Africa. The most southerly record to date is that given by VAILLANT, 1888, of a specimen captured at 20°44'N, 18°07'W, a position north of the Cape Verde Islands.

Genus **HALOSAUROPSIS** Collett, 1896

Res. Camp. Sci. Albert Ier Monaco, **10** : 146-152 ; type *Halosaurus macrochir* Günther, 1878.

Aldrovandia Goode and Bean, 1896 (part) (*A. macrochira* Goode and Bean, 1896) Oceanic Ichthyology.

Due to confusion concerning the publication date of GOODE and BEAN (see COHEN, 1963), the priorities of the two available generic names for the deep-living halosaurs have remained somewhat confused. There are, however, some grounds for separating the species among two genera ; *Halosauropsis* including only its type species, and *Aldrovandia* including the rest. This view is treated in detail by McDOWELL in his forthcoming monograph, and need not be discussed further here.

Halosauropsis macrochir (Günther, 1878)

Type in the British Museum (Nat. Hist.) London, in good condition (BMNH, 1887.12.7.237). This is the 545 mm lectotype (of HARRISSON, 1966) which was caught by the Challenger expedition, off Gibraltar, and is now preserved in spirit.

Halosaurus macrochir Günther, 1878, *Ann. Mag. nat. Hist.*, (5) **2** : 250.

Halosaurus goodei Gill, 1881 : 257.

Halosaurus macrochir : GÜNTHER, 1887 : 237-239 (plate LIX, fig. A) ; AGASSIZ, 1888 : 32.

Halosaurus goodii : VAILLANT, 1888 : 169-174 (pl. XVI, fig. 2, 2a-e).

Aldrovandia macrochira : GOODE and BEAN, 1896 : 133.

Halosauropsis macrochir : COLLETT, 1896 : 146-152 (pl. V, fig. 23, 23b) ; ROULE, 1919 : 29, 130, 133, 145 ; KOEFOED, 1927 : 65, 66 (text fig. 14, 15 ; pl. IV, fig. 7) ; ZUGMAYER, 1911 : 12, 13 ;

Roule and Angel, 1933 : 81 ; Nybelin, 1948 : 54-58 (reports 13 specimens not included in Harrisson's 1966 gazeteer).

Aldrovandia macrochir : Marshall, 1962 : 253, 254 ; Harrisson, 1966 : 450, 451, 457, 458, 461, 463, 466, 468, 470, 475, 479, 480, 483.

Iconography

Günther (1887) shows the lectotype from Gibraltar from the right side on his plate LIX (fig. A), which is a black and white lithograph slightly less than natural size. Figures a, a′, a″ on the same plate show dorsal, lateral and ventral views of the head. There is also a figure of a scale. Plate LX (fig. 1-8) gives details of the osteology of the head. Vaillant gives rather a poor black and white figure at 0.7 of the natural size (pl. XVI, fig. 2) in lateral view, together with dorsal and ventral aspects of the head at the same reduction. There are also figures of a scale in section (2d, 2e) and seen in surface view. Collett's, plate V, figure 23 shows his specimen (b) of the description on page 148, a fish of 615 mm length from the Azores, drawn natural size with the tail reflexed, exhibiting the right side. Figure 23b shows details of the lateral line and the neuromast organs. Koefoed, 1927, gives a good black and white lithograph, more accurate than the preceeding, if perhaps somewhat stiff and stylized. His text figures (14 and 15, p. 65) show additional details of the arrangement of the lateral line and the neuromast organs.

Eggs and larvae

Collett (1896) examined two females of *H. macrochir* (the larger of the two is that figured in his pl. V) with eggs 0.5 mm in diameter, which he designated as unripe. Zugmayer, 1911, reports two other gravid specimens. The eggs of one he describes as not fully ripe, those of the others as not at all. All three females were caught in either July or August. The actual breeding season is not known. The larva has yet to be described.

Distribution

This species is probably the deepest living of the halosaurs. It is found on the oozes and soft muds covering the lower slopes of the continental shelves, to depths of 3 000 m and temperatures between 2°C and 7°C. *H. macrochir* appears to range further North than other halosaurs in North East Atlantic, in agreement with its preference for the deeper and colder water masses. Koefoed (1927) reports specimens taken by the Michael Sars expedition at 50°22′N, 11°44′W, a position South-West of Ireland.

Genus **ALDROVANDIA** Goode and Bean, 1896

Oceanic Ichthyology : 129, 132. Type *Halosaurus rostratus* Günther, 1878, in the British Museum (BMNH 1887, 12.7.243), a specimen of 507 mm SL, in good condition ; " from the mid Atlantic ". Preserved in spirit.

Halosaurus : Günther, 1877, *H. affinis*, *Ann. Mag. nat. Hist.*, (4) **20** : 433.

Halosaurus : Günther, 1878, *H. rostratus*, *ibid.*, (5) **12** : 248.

Halosaurus : VAILLANT, 1888, *H. phalacrus*, Exp. Sci. « Travailleur et Talisman », Poissons : 50.

Aldrovandia phalacra (Vaillant, 1888)

Halosaurus phalacrus Vaillant, 1888, Exp. Sci. « Travailleur et Talisman », Poissons : 185-187. Type : Mus. nat. Hist. nat., Paris (MNHN 85-382), in good condition, from the Azores.
Aldrovandia phalacra : GOODE and BEAN, 1896 : 130, 134, fig. 156.
Halosaurus phalacrus : BRAUER, 1906 : 253 ; ZUGMAYER, 1911 : 11, 12 ; ROULE, 1919 : 28, 130.

ICONOGRAPHY

There are fewer adequate figures of *A. phalacra* than of the other halosaurs. VAILLANT, 1888, figures a scale, dorsal, lateral and central views of the head, the brain in dorsal view and gives a lateral habitus picture natural size. The drawing for all of these is weak, and the black and white lithographs give a rather poor impression of the fish. The figure in GOODE and BEAN is a simpler line drawing, and closely resembles VAILLANT's illustration from which it may have been taken.

EGGS AND LARVAE

ZUGMAYER (1911) describes a female taken on 18th August 1910 as having half ripe ovaries. The larva is unknown.

HABITAT AND DISTRIBUTION

A. phalacra is widely distributed in the Eastern North Atlantic between the Azores, the Canary Islands and the Cape Verde Plateau. Specimens are recorded from depths of between 1 000 m and 2 300 m where the temperature ranged from 4°C to 7°C, and where the bottom is composed of mud. Some of the deeper records edge on the zone of soft muds and globigerina ooze.

DISCUSSION

This report on the halosaurs of the North East Atlantic may be concluded with brief mention of the only larva known for certain to be that of a halosaur. Notes on relative abundance have not been given as there is too little information available. The early dredging reports (e.g. TANNER, 1886), combined with more recent bathyscaphe sightings (e.g. PÉRÈS, 1958), and photographic surveys (e.g. MARSHALL and BOURNE, 1965), suggest that halosaurs are common over much of the continental slope regions. For the most part however, the data that might be used as a basis for estimating relative abundances, does not allow of the certain determination of species : fishes seen from a bathyscaphe window or photographed with deep-sea cameras usually appear fleetingly as grey ghosts, and it is sometimes easiest to identify them from their shadows. In such cases, one cannot expect better than a generic identification.

HARRISSON (1966) described a specimen taken at a position close to 29°50'N, 22°57'W, clearly the leptocephalus stages of some species of halosaur. On the basis of a careful comparison of the meristic characters seen in the leptocephalus with the corresponding

features known in adult halosaurs, HARRISSON suggests this may be the young stage of an *Aldrovandia*, perhaps *A. affinis* (Günther, 1877). The low pectoral fin-ray numbers, and the small number of branchiostegal rays seem to exclude the possibility that the larva could belong to the genus *Halosaurus*. However it appeared that the larva possessed several characters reminiscent of the genus *Halosaurus*. It therefore seems quite possible that *Aldrovandia* larvae pass through a *Halosaurus*-like stage.

As has also been pointed out (HARRISSON, 1966 : 470), the few data available suggest that *Aldrovandia* species may have smaller eggs than do members of the genus *Halosaurus*. In this case *Halosaurus* species probably have a shorter larval life, which is reflected in turn by their more local patterns of distribution (e.g. *H. johnsonianus* confined to the East Atlantic, *H. radiatus* to the Gulf of Panama and the coast of Peru). Species of the genus *Aldrovandia* tend to be widely distributed. *A. macrochir* is known from the both sides of the North Atlantic as well as from the Prince Edward Islands in the souther Indian Ocean. *Aldrovandia affinis* is the only halosaur currently known to have a worldwide distribution ; the types described by GÜNTHER (1877) were from Japan, while other specimens have been taken from the Gulf of Mexico (GOODE and BEAN, 1896 ; GREY, 1956), South Africa (GILCHRIST and VON BONDE, 1924, etc.) and the Indian Ocean (ALCOCK, 1889, 1890, 1896 ; NORMAN, 1939, etc.). In *Aldrovandia* the span of larval life is very probably of a considerable length, so that the leptocephalus acts as a pelagic distributive stage in the life history.

The discovery of a metamorphosing halosaur larva over deep water in the open ocean of the Canary basin, presents of itself the likelihood that such a specimen would belong to the genus *Aldrovandia*. Taken in conjunction with the meristic data, it seems most improbable that the only known leptocephalus should be that of a species of *Halosaurus*, and especially not that of a locally confined species, such as *H. johnsonianus*, which is known at present by only a very few records from the Atlantic Islands separated from that Eastern continental shelf which appears to represent its principal home territory. Until more halosaur leptocephali become known, it seems wise to accept that the specimen described at present may best be assigned to the species *A. affinis*. There are no currently published records of the latter species from the Eastern Atlantic, and the larva itself is only included in the present section as being of interest to the biology of the Heteromi. However, MCDOWELL (*in litt.*) informs me that a specimen from Northwest Africa in the U.S. National Museum may in fact represent this species. If so, then the tentative identification of the larva seems yet more probably correct.

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